

FIG. 1: Single User Matched Filter Correlator (Prior Art)

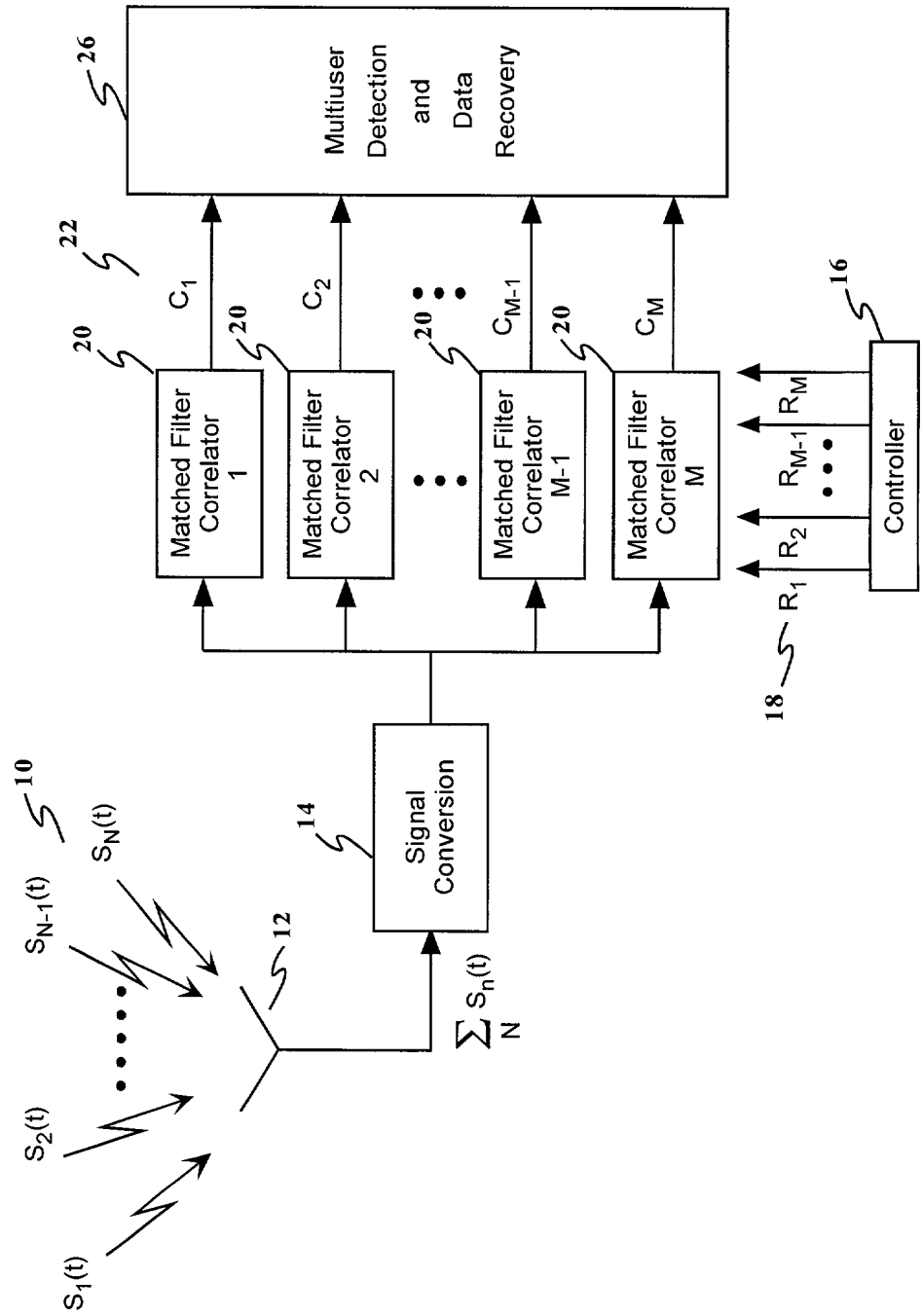


FIG. 2: Multiuser Matched Filter Correlators (Prior Art)

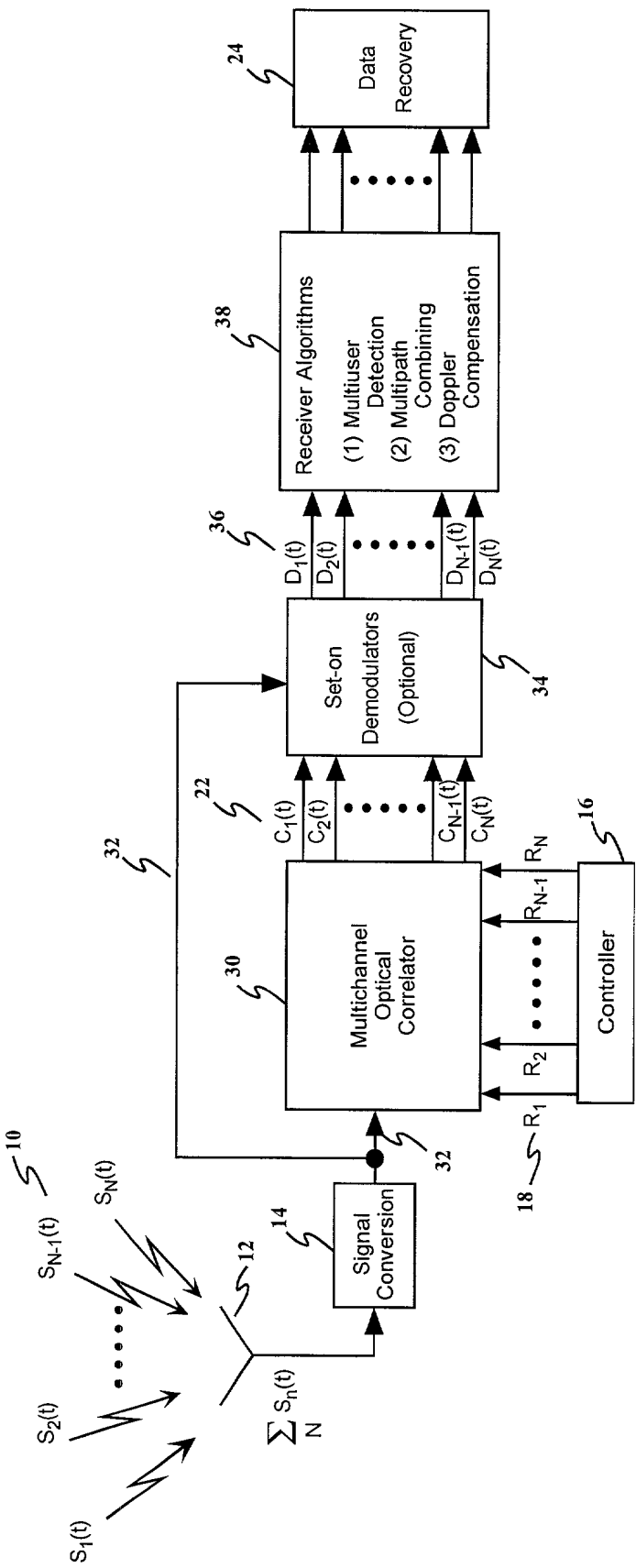


FIG. 3: OPERA Block Diagram

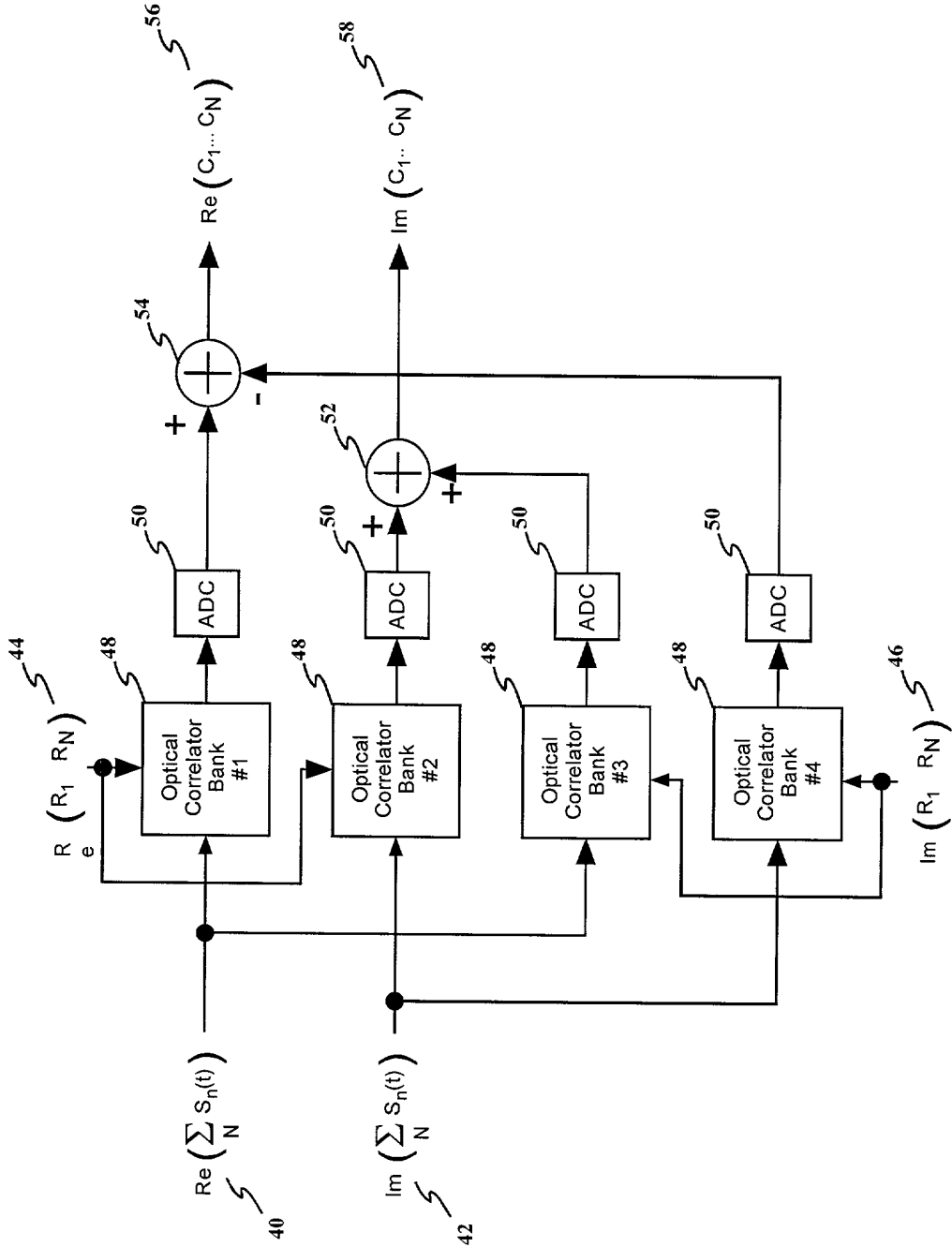


FIG. 4: Complex Baseband Correlator

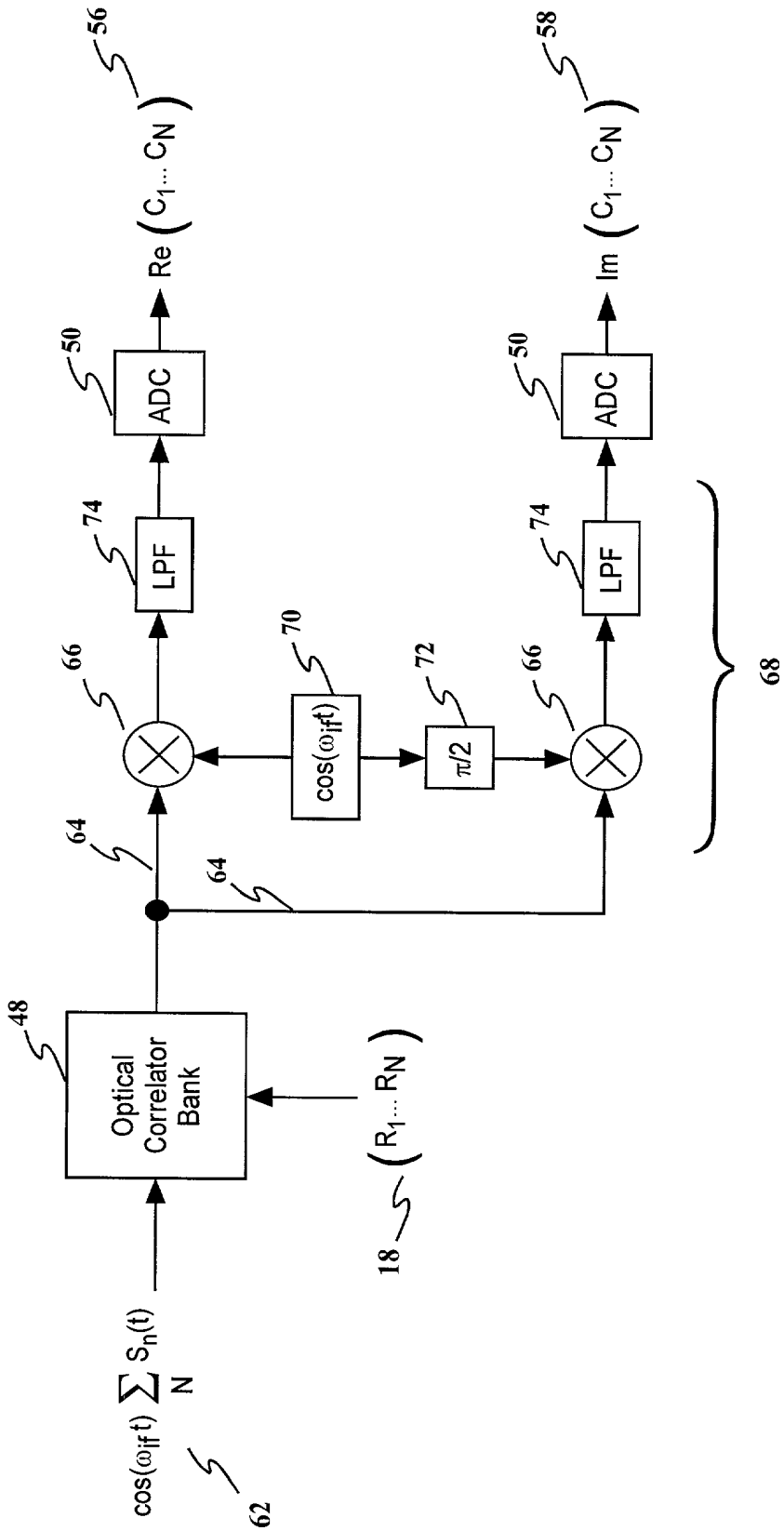


FIG. 5: Complex Intermediate Frequency Correlator

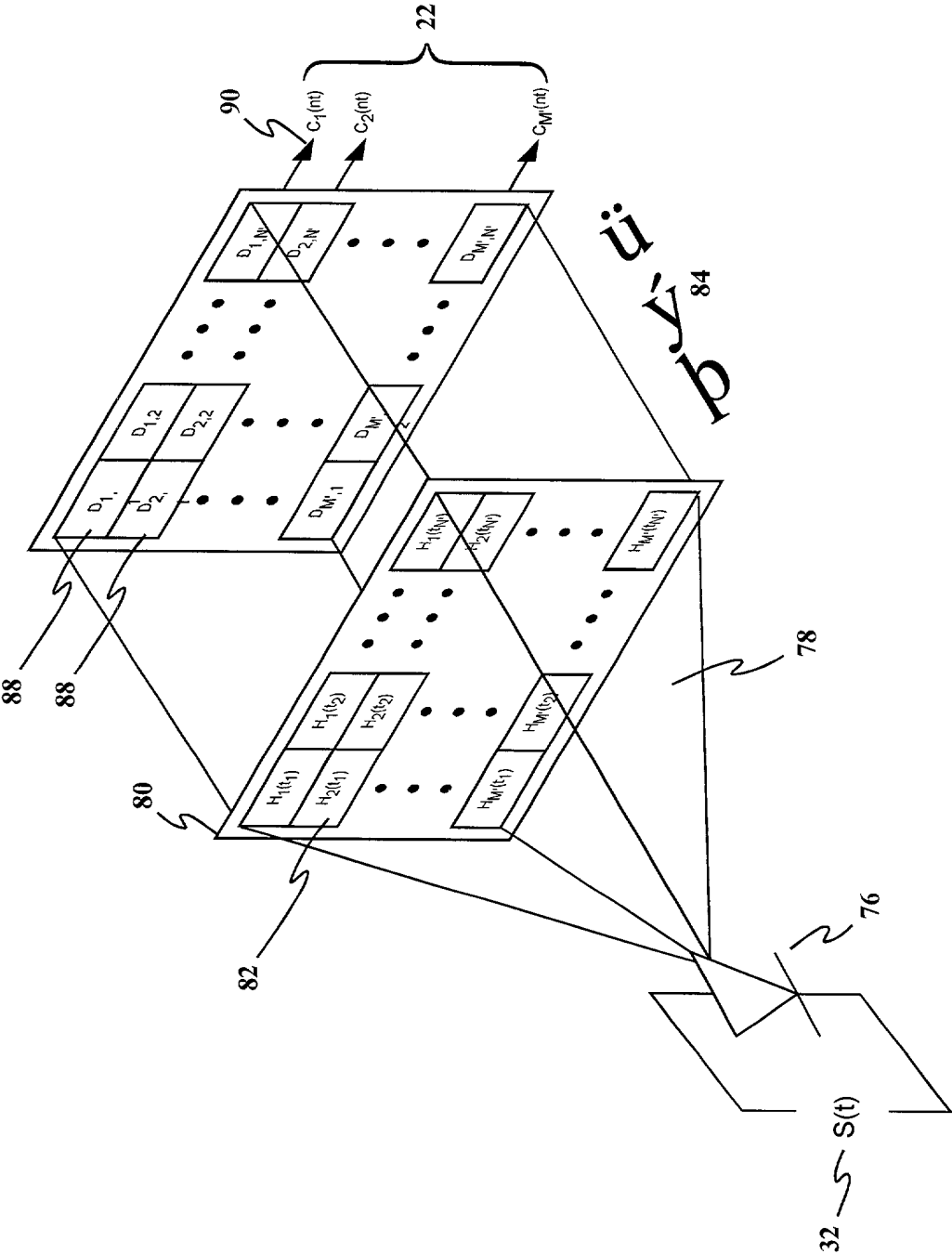
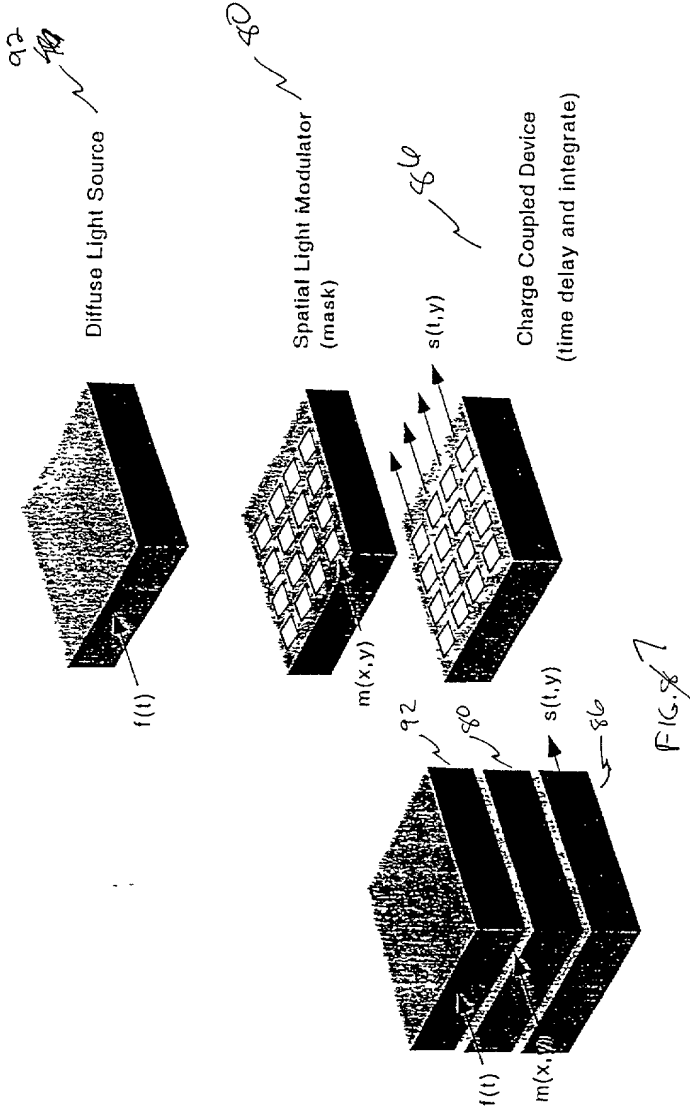


FIG. 6: DDID Architecture



Time t	Operation	CCD site				CCD output y
		(1, y)	(2, y)	(3, y)	(4, y)	
0	Start	0	0	0	0	0
1	s(1)	s(1) m(1,y)	s(1) m(2,y)	s(1) m(3,y)	s(1) m(4,y)	0
2	Shift + s(2)	s(2) m(1,y)	s(1) m(1,y) + s(2) m(2, y)	s(1) m(2,y) + s(2) m(3,y)	s(1) m(3,y) + s(2) m (4, y)	s(1)m(4,y)
3	Shift + s(3)	s(3) m(1,y)	s(2) m(1, y) + s(3) m (2, y)	s(1) m(1,y) + s(2) m(2,y) + s(3) m (3, y)	s(1) m(2,y) + s(2) m(3,y) + s(3) m (4, y)	s(1) m(3,y) + s(2) m(4,y)
4	Shift + s(4)	s(4) m(1,y)	s(3) m(1,y) + s(4) m(2, y)	s(2) m(1, y) + s(3) m (2, y) + s(4) m(3, y)	s(1)m(1,y) + s(2) m(2, y) + s(3) m(3,y) + s(4) m(4, y)	s(1) m(2,y) + s(2) m(3, y) + s(3) m(4,y)
5	Shift + s(5)	s(5) m(1,y)	s(4) m(1,y) s(5) m(2,y)	s(3)m(1,y) + s(4)m (2,y) + s(5)m(3,y)	s(2) m(1,y) + s(3) m(2,y) + s(4) m(3,y) + s(5)m(4,y)	s(1) m(1,y) + s(2) m(2,y) + s(3) m(3,y) + s(4) m(4,y)
6	Shift + s(6)	s(6) m(1,y)	s(5) m(1,y) + s(6) m(2,y)	s(4) m(1,y) + s(5) m(2,y) + s(6) m(3,y)	s(3) m(1,y) + s(4) m(2,y) + s(5) m(3,y) + s(6) m(4,y)	s(2) m(1,y) + s(3) m(2,y) + s(4) m(3,y) + s(5) m(4,y)

FIG. 8: DDID Operation (4 Stage TDI)

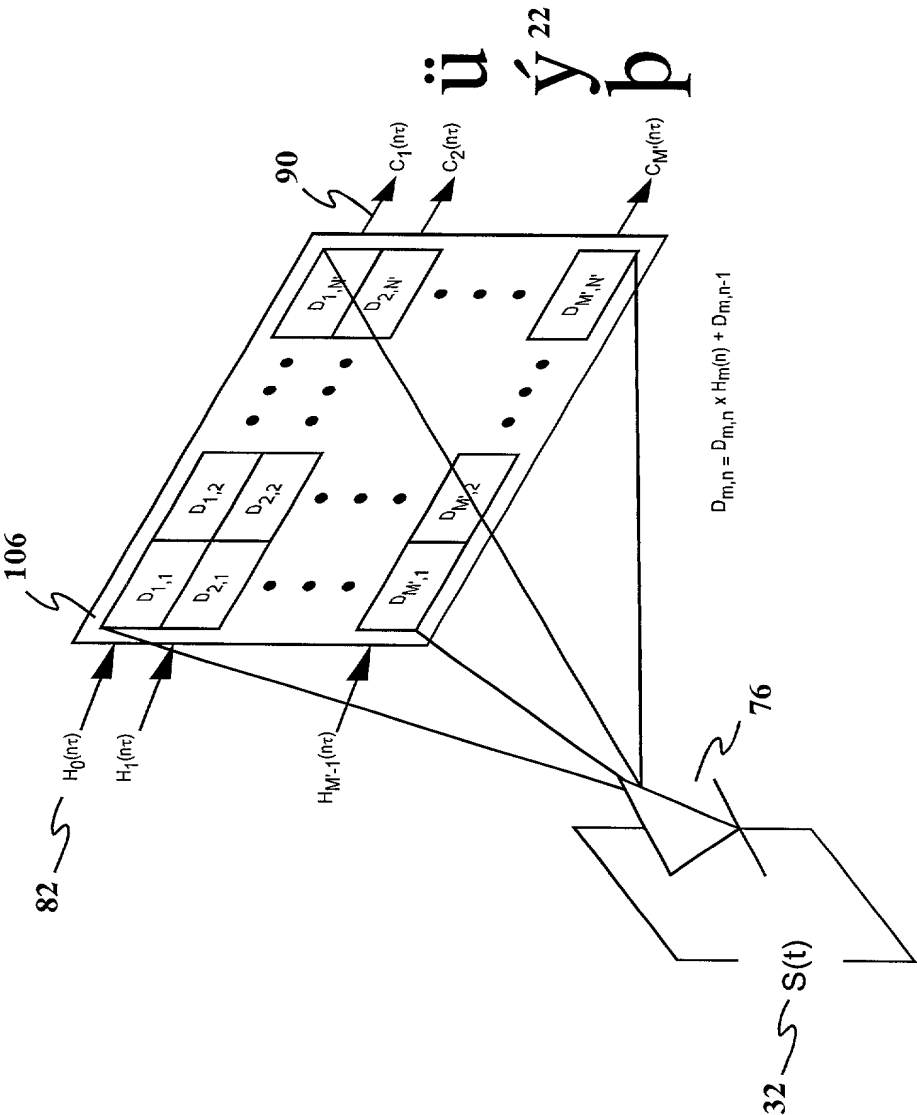


FIG. 9: Integrated Mask and Detector Architecture

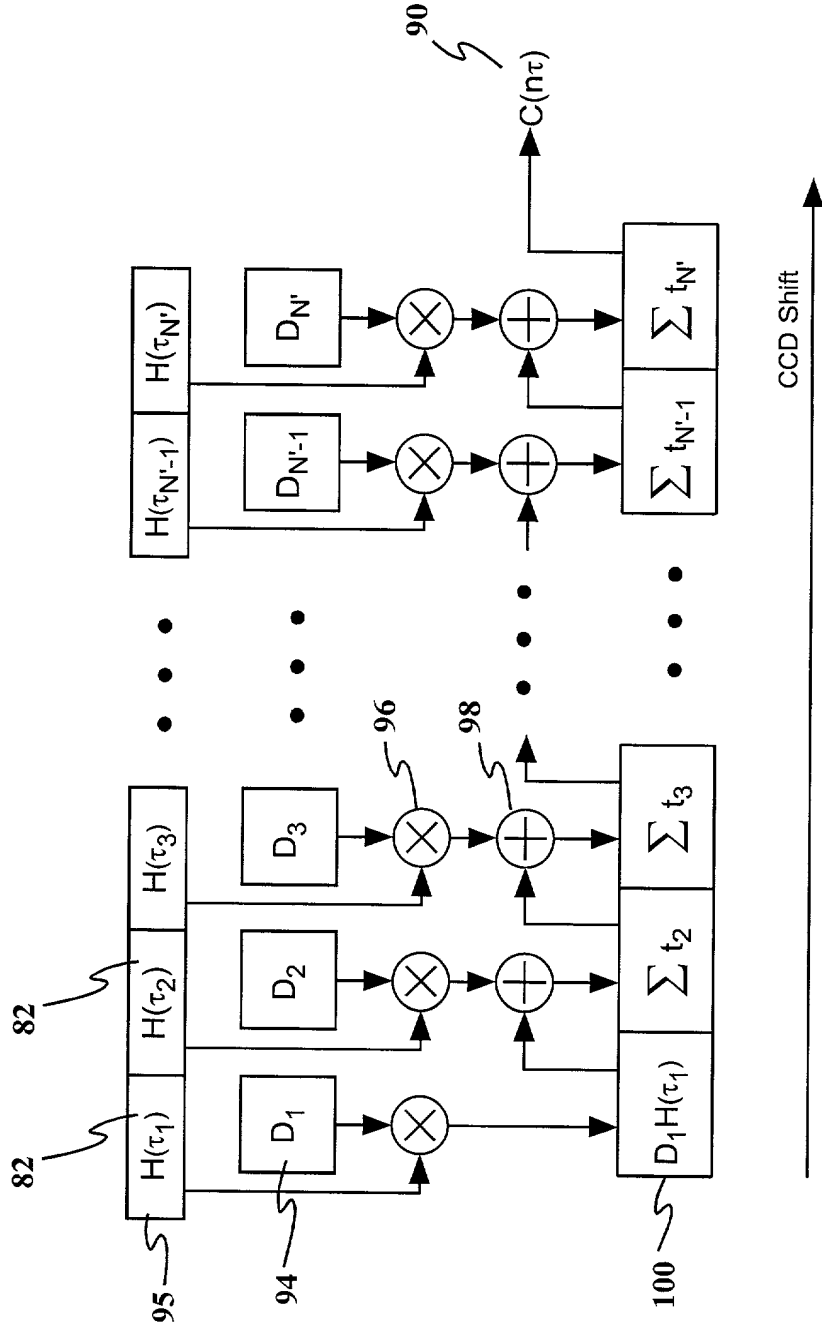
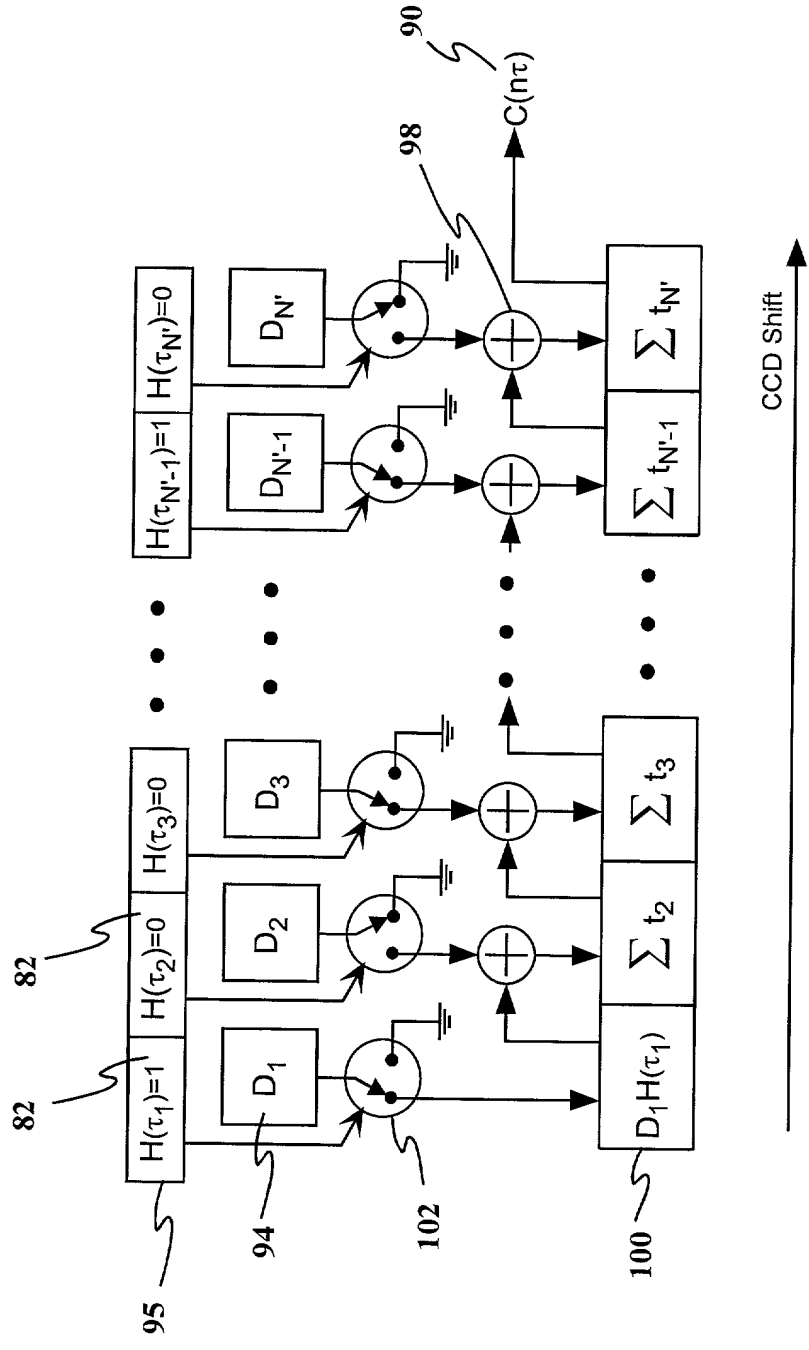


FIG. 10: General Multiplying Integrated Hypothesis and TDI Detector



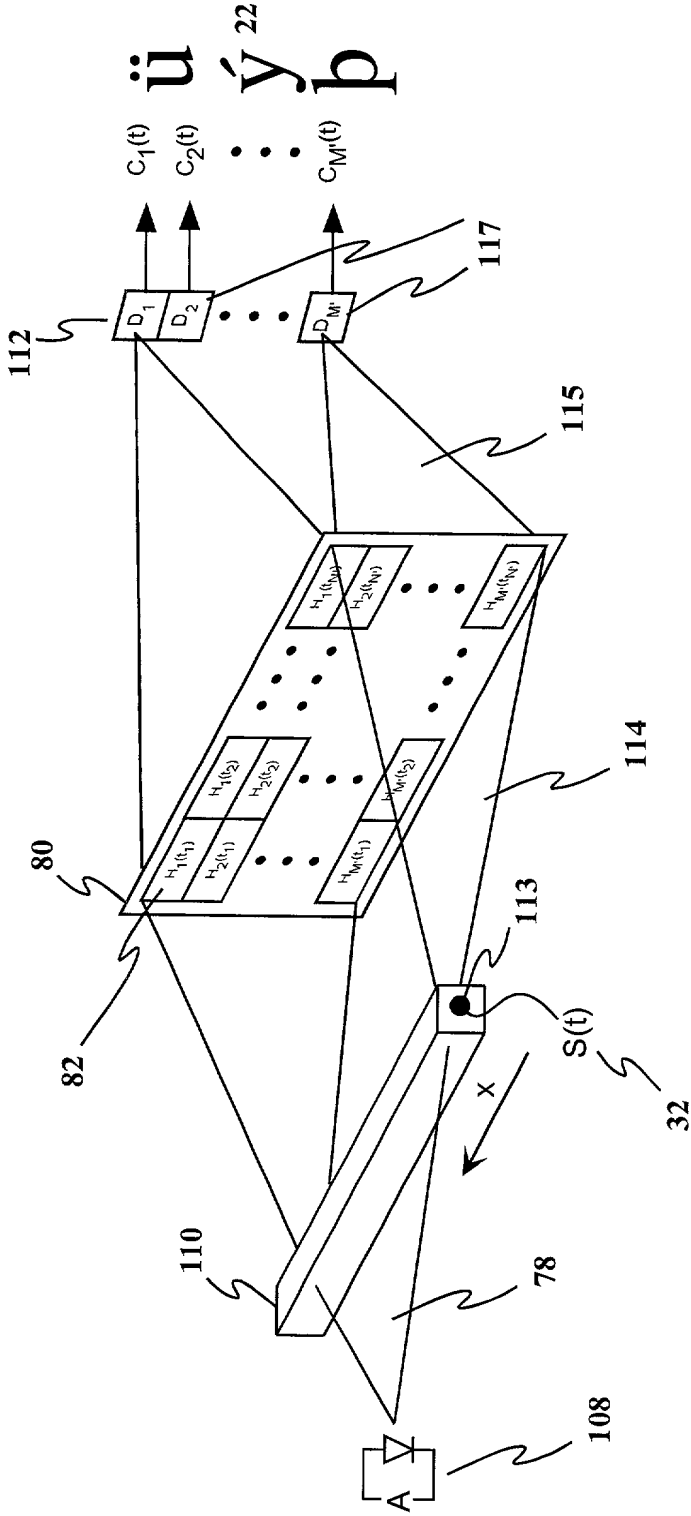
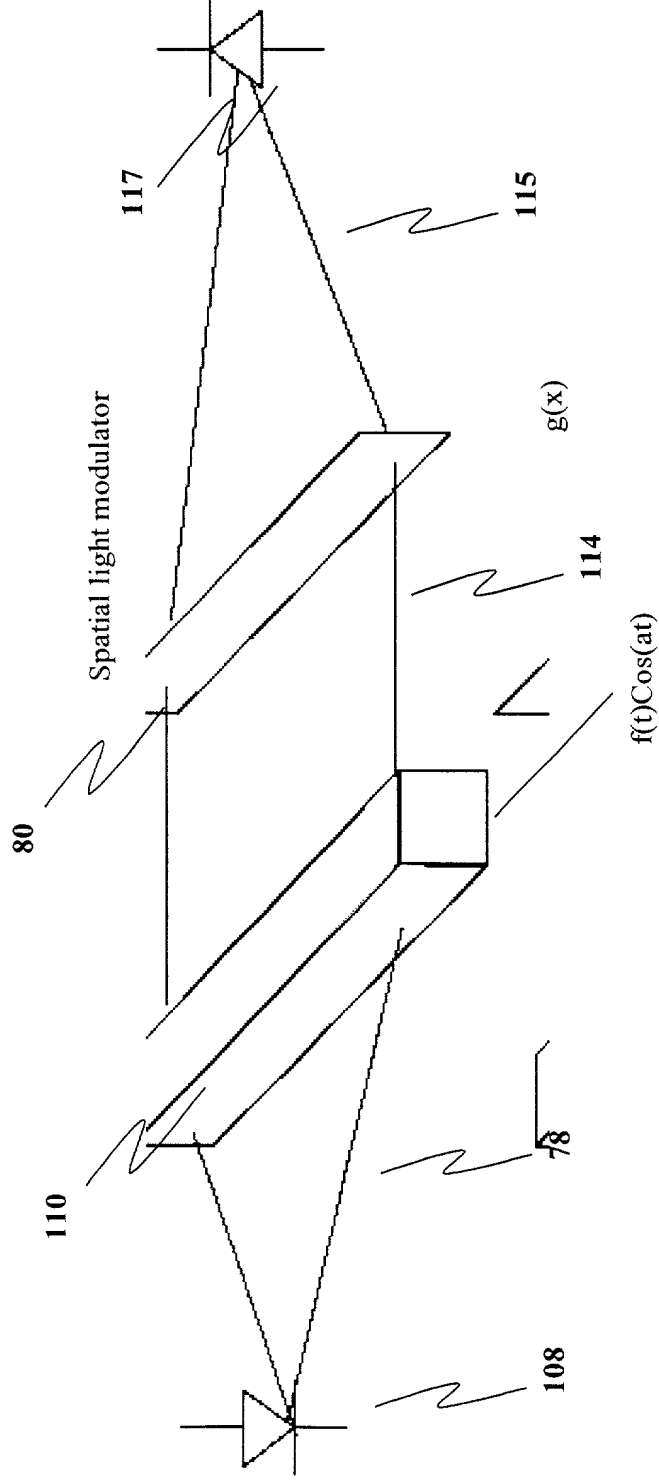


FIG. 12: Space Integration Traveling Wave Displacement Architecture

FIG. 13: Single Channel of Space Integration Traveling Wave Displacement



$$\text{output}(t) = e^{ja(t - \frac{T}{2})} \int_0^{\frac{T}{2}} g(x) f(t - \frac{x}{2} + \frac{T}{2}) e^{-j\omega_x x} dx$$

$$power(t) = \left| \int_0^T g(x) f(t - \frac{T}{2} + \frac{x}{v}) e^{-j\omega_x x} dx \right|^2$$

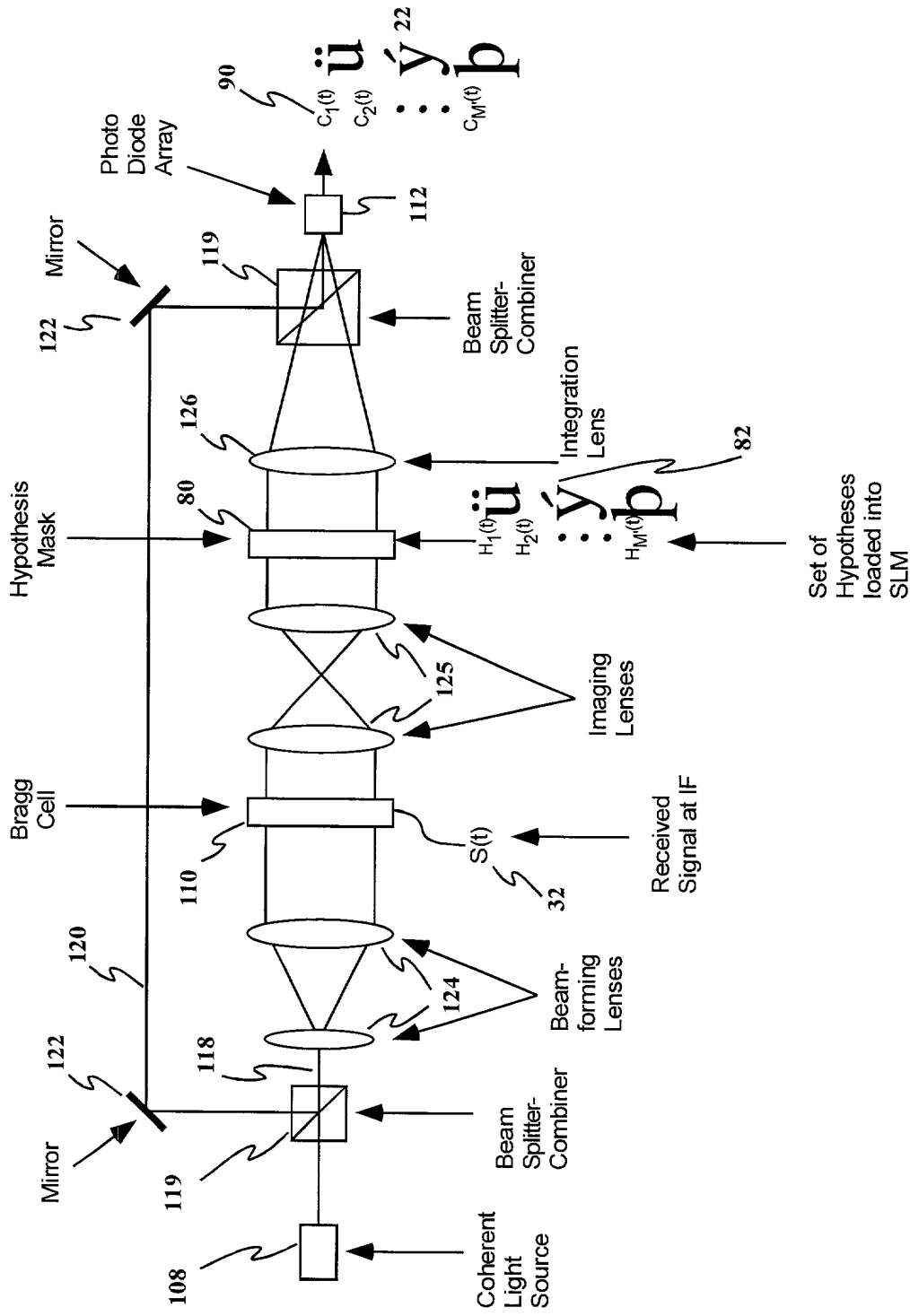


FIG. 14: Space Integration Traveling Wave Displacement Architecture with Coherent Detection

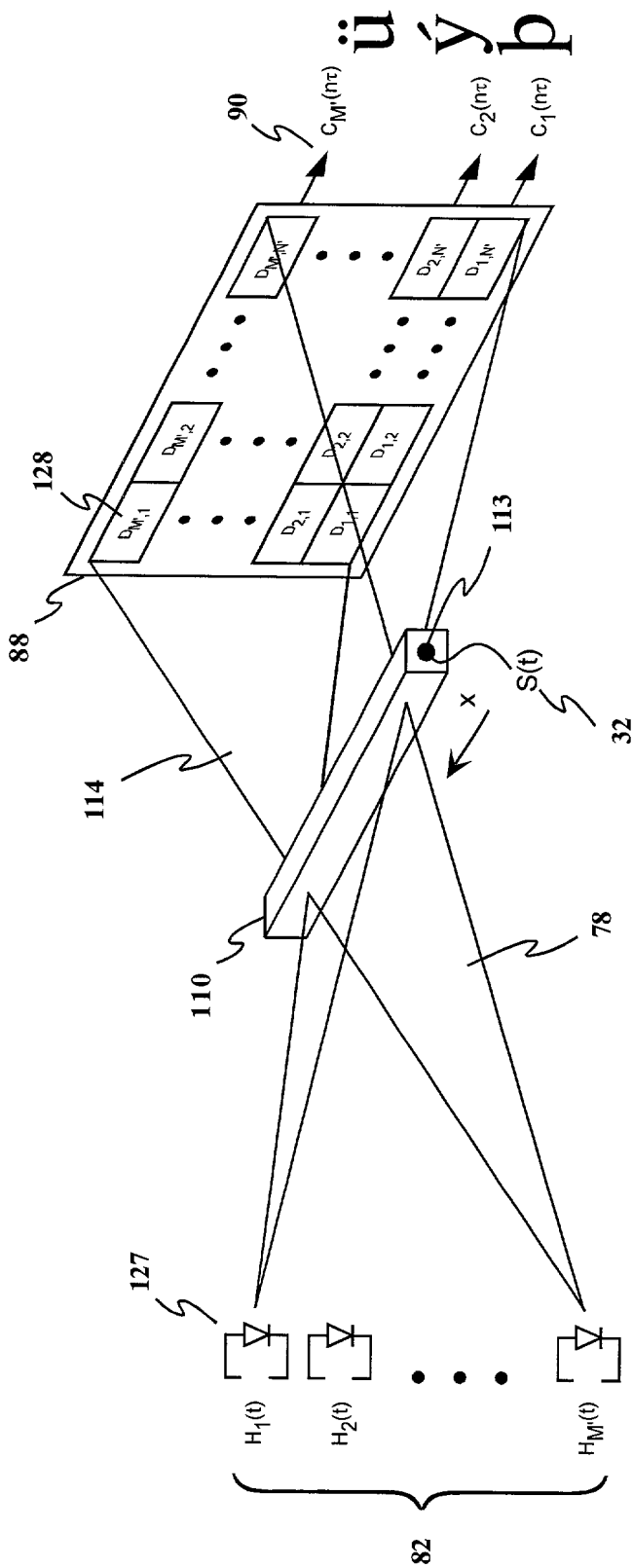
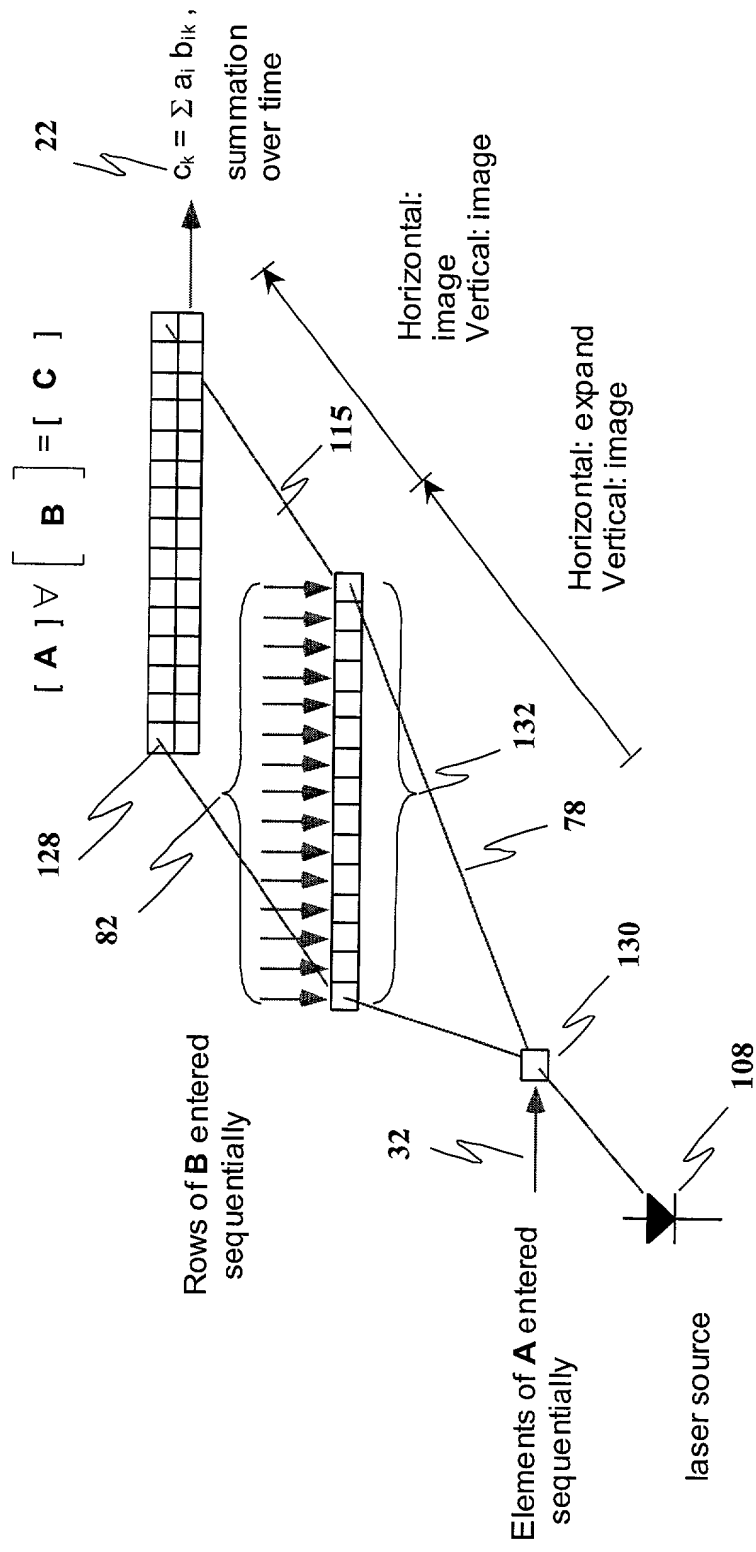


FIG. 15: Detector Integrating, Traveling Wave Displacement Architecture



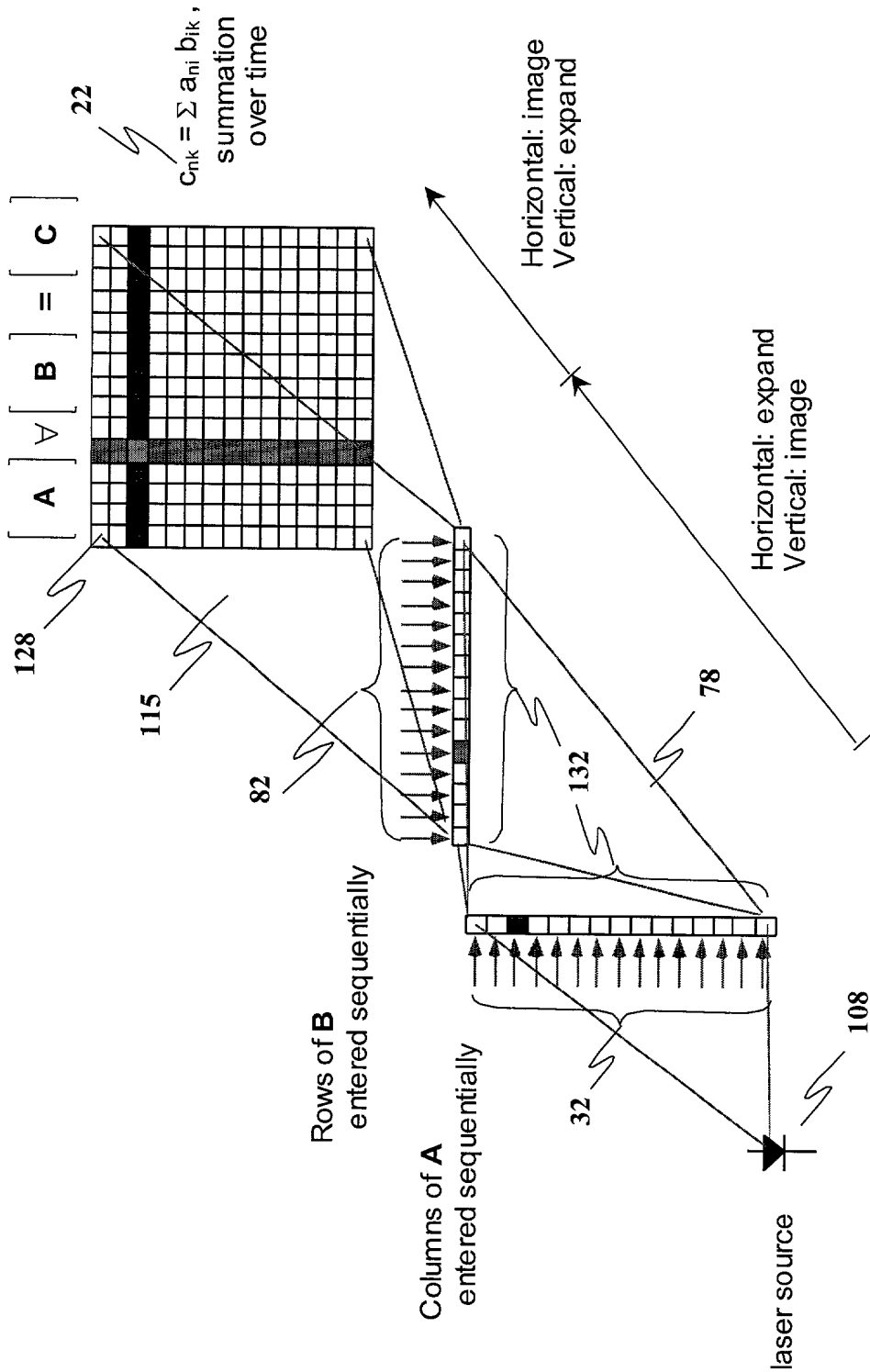


FIG. 17: Time Integrating Matrix-Matrix Multiplier

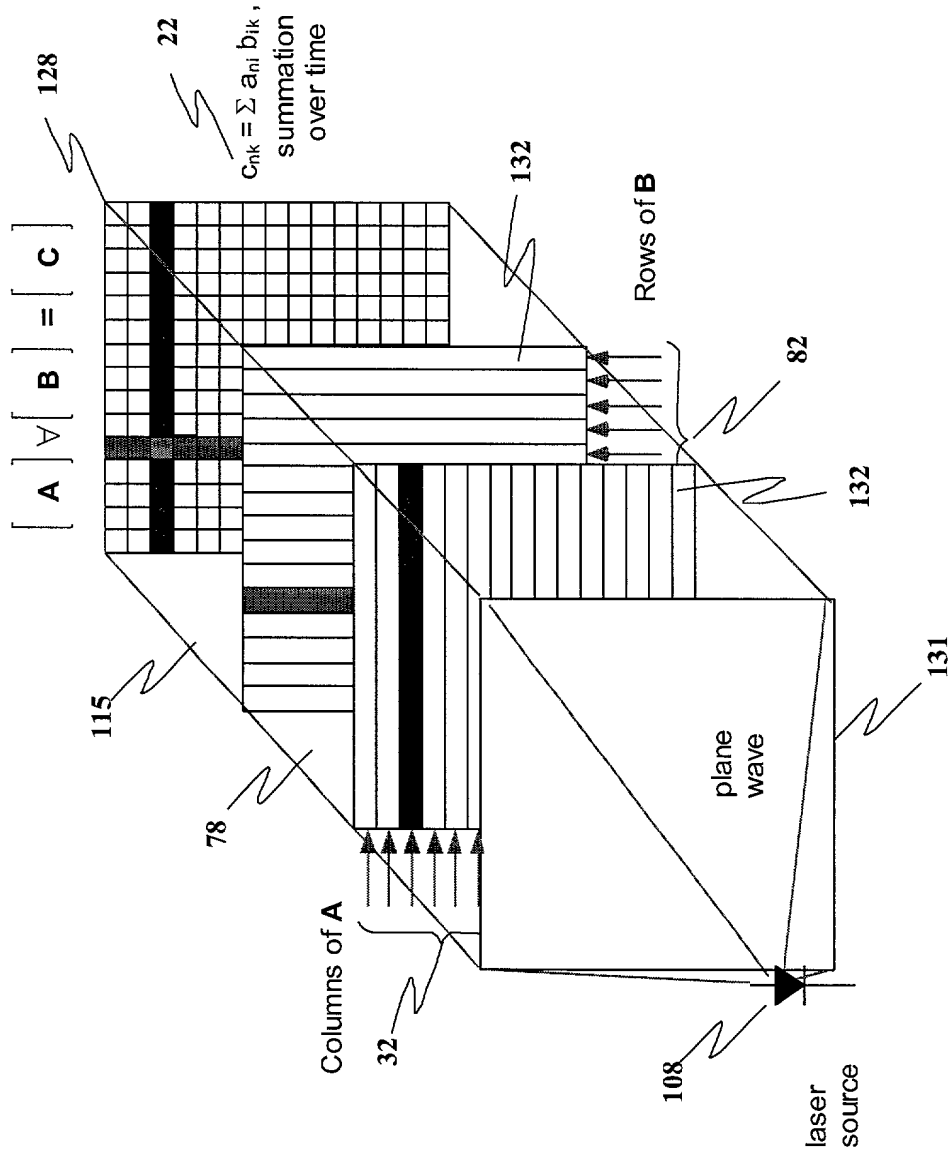


FIG. 18: Compact Time Integrating Matrix-Matrix Multiplier

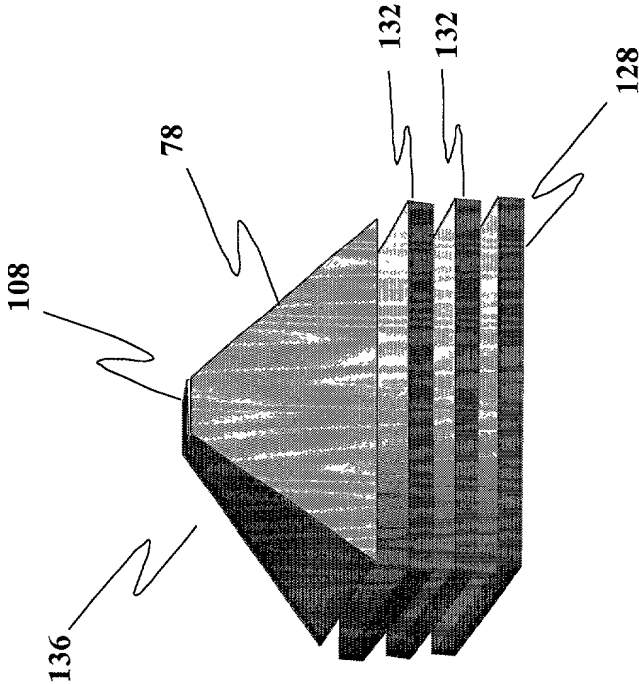


FIG. 19: Compact Module Stack